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Lee et al.

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(54) **FASTENER FOR MOUNTING HEAT-RADIATOR TO ELECTRONIC DEVICE**

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H05K 7/20 (2006.01)
H01L 23/34 (2006.01)
A44B 17/00 (2006.01)
F16B 13/00 (2006.01)

(52) **U.S. Cl.** **361/719**; 24/294; 411/509; 257/719

(58) **Field of Classification Search** 24/294; 361/710, 719; 257/718–719; 411/508–509
See application file for complete search history.

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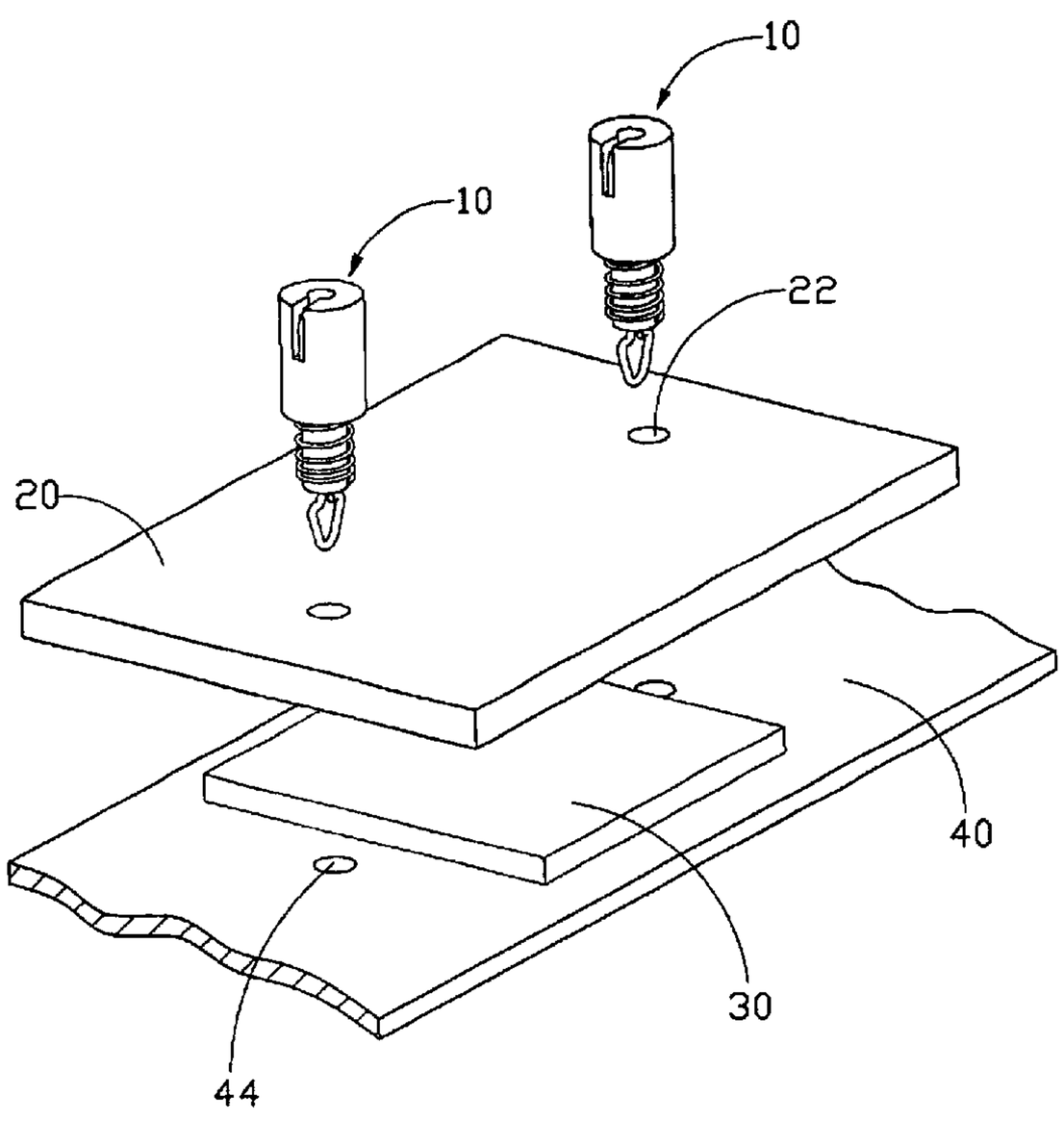
(57) **ABSTRACT**

A fastener (**10**) for mounting a heat-radiator (**20**) to an electronic device (**30**) on a circuit board (**40**) is disclosed. The heat-radiator and the circuit board have aligned holes (**22**, **44**). The fastener includes a head (**11**) having an upper portion (**112**) with a large diameter and a lower portion (**113**) with a smaller diameter, a cylindrical spring (**14**) captured around the lower portion of the head for exerting a spring force against the heat-radiator, and a metallic wire (**15**) having a first end portion fixed on said head and a second end portion bent to form an engaging portion (**152**). The engaging portion of the metallic wire compressively passes through the aligned holes of the heat-radiator and the circuit board and is engaged with an underside of the circuit board.

15 Claims, 4 Drawing Sheets



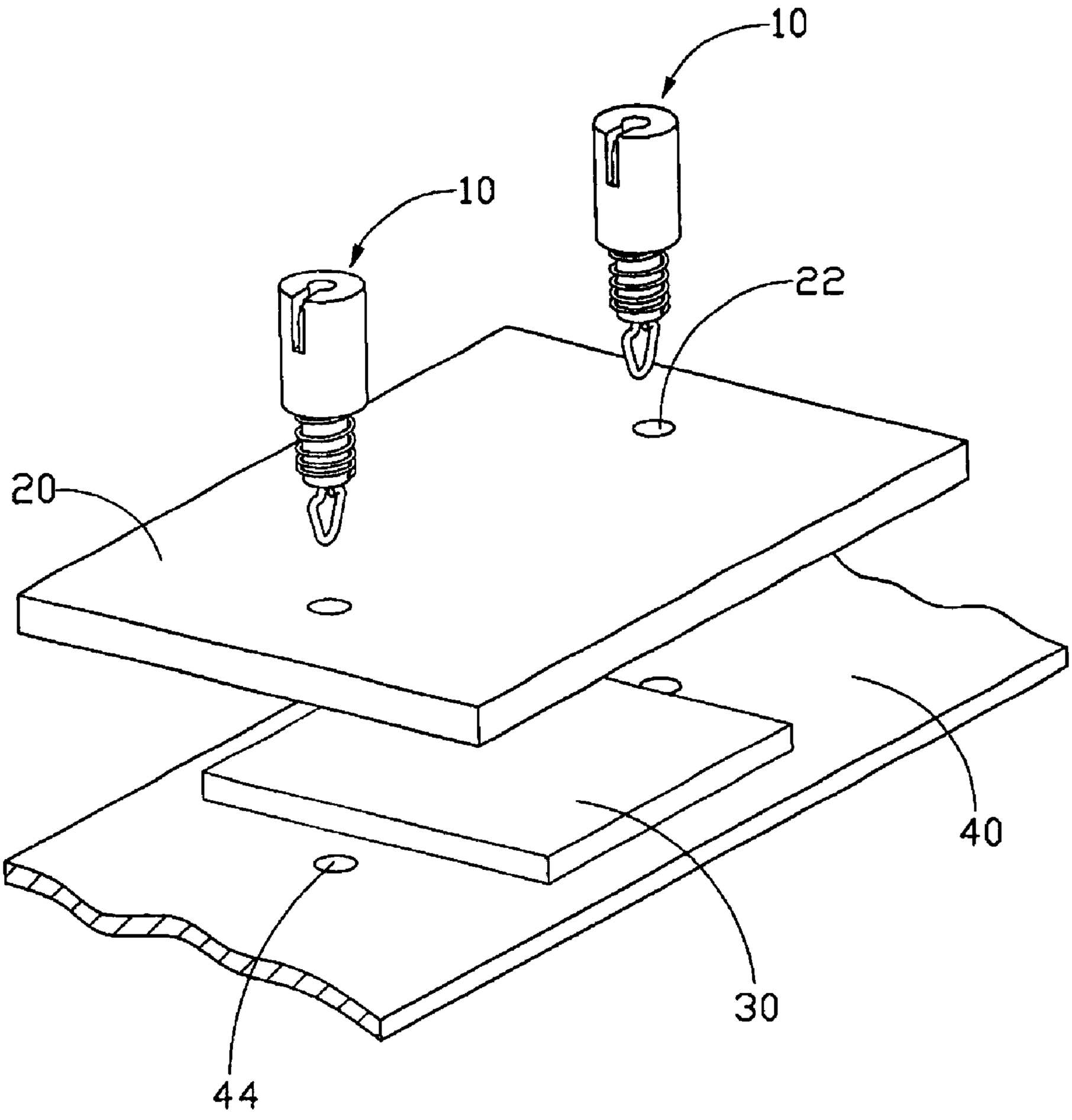


FIG. 1

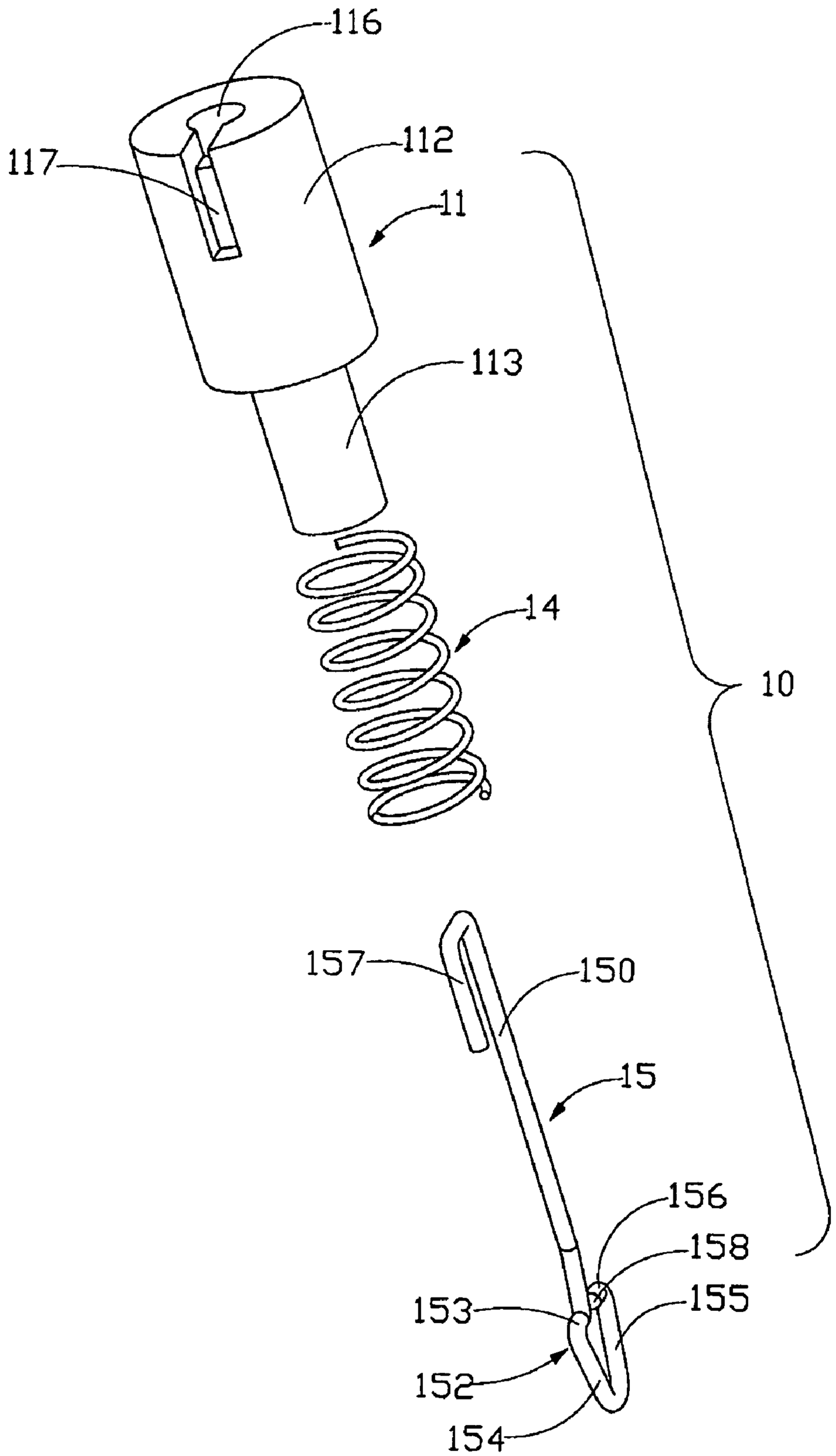


FIG. 2

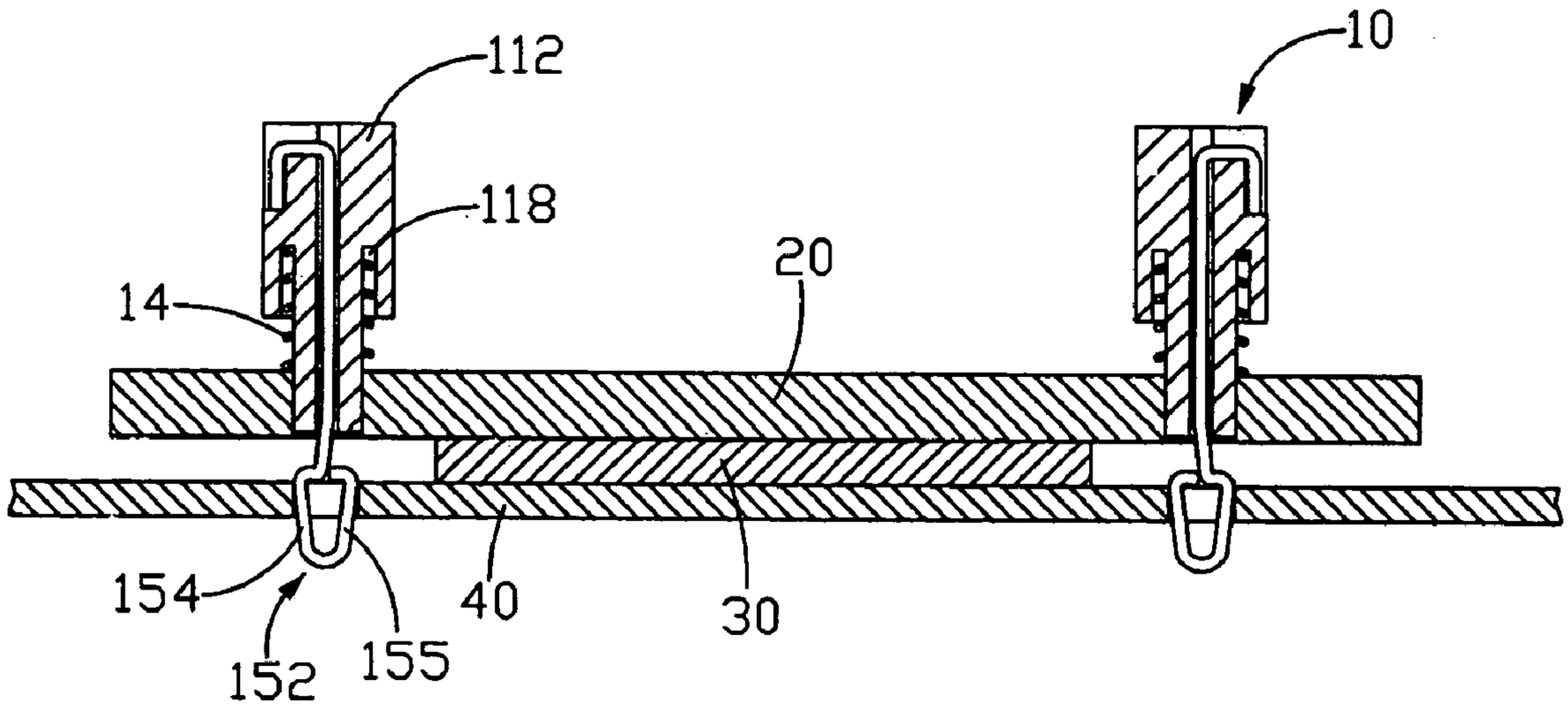

112
10
118
20
14
154
152
155
40
30

FIG. 3

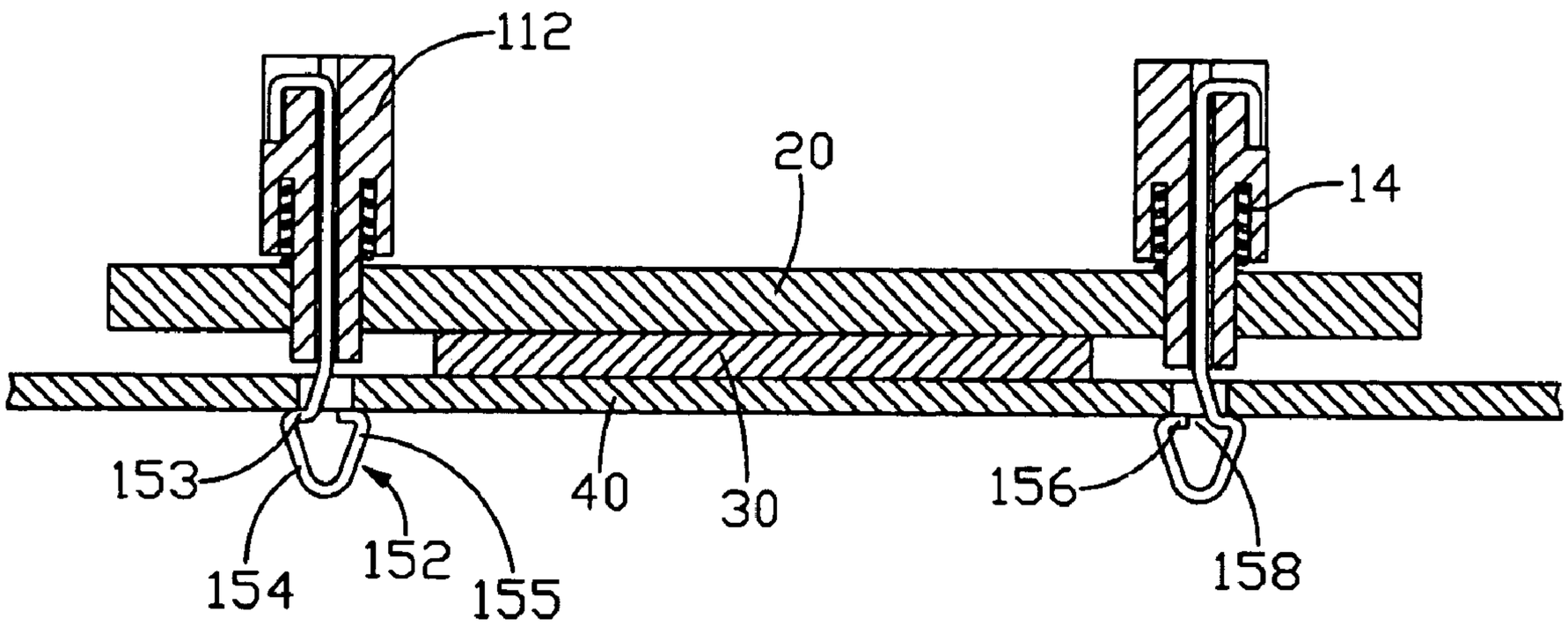

112
20
14
153
154
152
155
40
30
156
158

FIG. 4

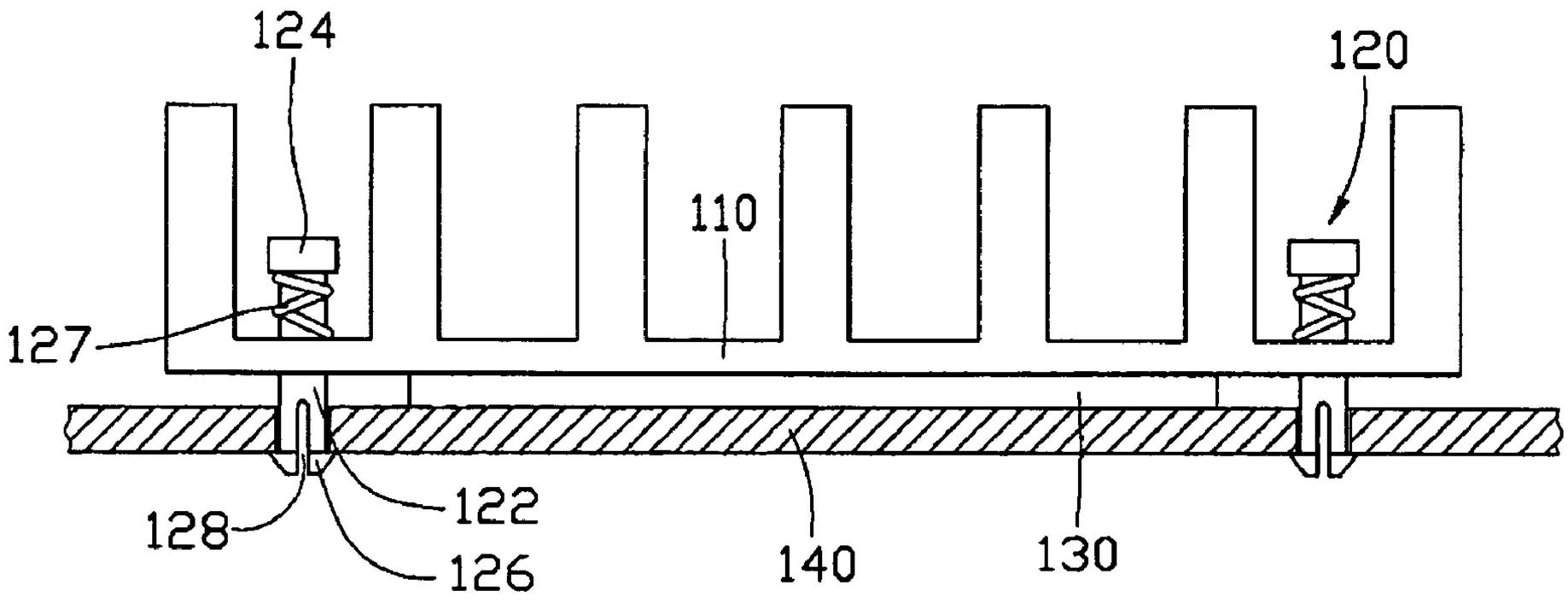


FIG. 5 (PRIOR ART)

FASTENER FOR MOUNTING HEAT-RADIATOR TO ELECTRONIC DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a fastener, and more particularly to a fastener used for mounting a heat-radiator to an electronic device on a circuit board.

2. Description of Prior Art

Electronic devices such as central processing units (CPUs) are the core administrator of electrical signals in most contemporary personal computers. Continued development of CPUs has enabled them to perform more and more functions. Heat generated by CPUs has increased commensurately. Such heat can adversely affect the operational stability of computers. Measures must be taken to efficiently remove the heat from the CPUs. Typically, a heat-radiator is mounted on a CPU to remove heat therefrom.

A number of conventional fasteners are used to mount the heat-radiator to the CPU. The fasteners extend through holes in the heat-radiator and the circuit board, and are constructed to exert a spring force that presses the heat-radiator against the CPU. As shown in FIG. **5**, conventional fasteners **120** for mounting a heat-radiator **110** to a CPU **130** installed on a circuit board **140** are disclosed. The fastener **120** has a leg **122**, a head **124** formed at a first end of the leg **122** and a cone-shaped foot **126** formed at a second end of the leg **122**. The foot **126** has an engaging portion at a top thereof and an insertion end at a bottom thereof. Both the head **124** and the engaging portion of the foot **126** have a diameter larger than the leg **122**, whereas the insertion portion of the foot **126** has a diameter smaller than the leg **122**. A cylindrical spring **127** is located around a periphery of the leg **122** and between the head **124** and the foot **126**. A channel **128** is longitudinally defined through the foot **126** and at least a portion of the leg **122** adjacent to the foot **126**. Thus when the heat-radiator **110** is mounted, the foot **126** of the fastener **120** is squeezed to sequentially travel through corresponding holes in the heat-radiator **110** and the circuit board **140**. After the engaging portion of the foot **126** extends the hole of the circuit board **140**, the foot **126** recovers to its original state whereby the engaging portion of the foot **126** is engaged with an underside of the circuit board **140**. At the same time, the spring **127** is pressed to push against a top surface of the heat-radiator **110**. Thus the heat-radiator **110** is mounted on the CPU **130** for heat dissipation.

However, the fastener **120** is usually integrally made from plastic material by injection molding method. The engaging portion of the foot **126** of the fastener **120** has a tendency of wearing out during insertion action. The heat-resistance property of the fastener **120** is also not satisfactory. When used at a high temperature environment, the engaging portion of the foot **126** is prone to deform overly, and as a result, the heat-radiator **110** become loose or even dropped from the circuit board **140**.

Therefore, it is desired to provide an improved fastener to obviate the aforementioned problems.

SUMMARY OF THE INVENTION

Accordingly, an object of the present invention is to provide a fastener which can securely fasten a heat-radiator to an electronic device on a circuit board.

In order to achieve the object set out above, a fastener in accordance with the present invention is used for mounting a heat-radiator to an electronic device on a circuit board. The heat-radiator and the circuit board have aligned holes. The fastener comprises a head, an elastic member and a metallic wire. The head has an upper portion with a large diameter and a lower portion with a smaller diameter. The elastic member is a cylindrical spring captured around said lower portion of said head and beneath said upper portion for urging the heat-radiator towards the electronic device. A first end portion of the metallic wire is fixed on the head and a second end portion thereof is bent to form an engaging portion. The engaging portion of the metallic wire can compressively and sequentially pass through corresponding holes of the heat-radiator and the circuit board to engage with an underside of the circuit board. The spring exerts a spring force on the heat-radiator towards the electronic device. Thus, the heat-radiator is firmly mounted to the electronic device for heat dissipation.

Other objects, advantages and novel features of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective view shows a pair of fasteners in accordance with the present invention to fasten a heat-radiator on an electronic device on a circuit board;

FIG. **2** is an exploded view of a fastener of FIG. **1**;

FIG. **3** is a side sectional and a partly assembled view of FIG. **1**;

FIG. **4** is a side sectional and a completely assembled view of FIG. **1**; and

FIG. **5** is a partly sectional view of a conventional fastener fastening a heat-radiator on a circuit board.

DETAILED DESCRIPTION OF THE INVENTION

Reference will now be made to the drawing figures to describe the present invention in detail.

FIG. **1** shows a pair of fasteners **10** in accordance with the present invention, for mounting a heat-radiator **20** to an electronic device **30** which is installed on a circuit board **40**. The heat-radiator **20** and the circuit board **40** have aligned holes **22**, **44** defined thereon.

Referring also to FIG. **2**, the fastener **10** comprises a head **11** and a metallic wire **15**. The head **11** has an upper portion **112** and a lower portion **113** connected with the upper portion **112**. Both the upper and lower portions **112**, **113** of the head **11** have a cylindrical profile. The upper portion **112** has a larger diameter than the lower portion **113**, and the diameter of the lower portion **113** is corresponding to that of the holes **22**, **44** of the heat-radiator **22** and the circuit board **40**. A straight hole **116** is defined longitudinally through a center of the upper and lower portions **112**, **113** of the head **11**. A slot **117** is defined at a top and outside surface of the upper portion **112** of the head **11** and is communicated with the hole **116** at the top surface of the upper portion **112**. A first end portion of the metallic wire **15** including a stem **150** is inserted through the hole **116** of the head **11**, and is bent successively and downwardly to form a fixing end **157**. The fixing end **157** is received in the slot **117** for fixing the metallic wire **15** therein. A second end portion of the metallic wire **15** is bent to form an engaging portion **152**. The engaging portion **152** is formed by bending the second

end portion of the metallic wire **15** outwardly to form a first support **153**, and then bending it downwardly and inwardly to form a first leg **154**, and then bending it to form a second leg **155** and a second support **156** which are symmetrical to the first leg **154** and the first support **153**, leaving a gap **158** existed between the first and second supports **153**, **156**. A maximum width between the first and second supports **153**, **156** is larger than the diameter of the holes **22**, **44** of the heat-radiator **20** and the circuit board **40**. An elastic member, preferably a cylindrical spring **14** is located around the lower portion **113** of the head **11** and beneath the upper portion **112** thereof, although other elastic member such as metal sheet is also practical. Suitably, at least partially of the spring **14** is received in an annular groove **118** (See FIG. **3**) defined at a conjunction of the upper portion **112** and the lower portion **113** of the head **11**.

Referring also to FIG. **3** and FIG. **4**, when used, the fastener **10** is disposed on the heat-radiator **20** with the engaging portion **152** of the metallic wire **15** facing the holes **22**, **44** of the heat-radiator **20** and the circuit board **40**. The upper portion **112** of the head **11** is then pushed downwardly. The first and second legs **154**, **155** of the engaging portion **152** of the metallic wire **15** are squeezed to sequentially travel through the holes **22**, **44** of the heat-radiator **20** and the circuit board **40**. After the engaging portion **152** of the metallic wire **15** extends through the hole **44** of the circuit board, the engaging portion **152** recovers to its original state whereby the first and second supports **153**, **156** of the engaging portion **152** are engaged with an underside of the circuit board **40**. At the same time, the spring **14** is compressed to push against a top surface of the heat-radiator **20**. Thus, the heat-radiator **20** is firmly secured to the electronic device **30** for heat dissipation.

In comparison with conventional fasteners made from plastic materials, the engaging portion **152** of the fastener **10** of the present invention is made from metallic wire. Consequently, it can prevent the engaging portion **152** of the fastener **10** from wearing out during frequently insertion actions. Also the engaging portion **152** of the fastener **10** has good heat-resistance property and can prevent from deforming overly when used at a high temperature environment.

It is to be understood, however, that even though numerous characteristics and advantages of the present invention have been set forth in the foregoing description, together with details of the structure and function of the invention, the disclosure is illustrative only, and changes may be made in detail, especially in matters of shape, size, and arrangement of parts within the principles of the invention to the full extent indicated by the broad general meaning of the terms in which the appended claims are expressed.

What is claimed is:

1. A fastener for mounting a heat-radiator to an electronic device on a circuit board, the heat-radiator and the circuit board having aligned holes, the fastener comprising:

a head for exerting a force to the heat-radiator,

a metallic wire having a substantially straight first end portion fixed on said head and a second end portion bent to form an engaging portion, said engaging portion adapted for compressively passing through the aligned holes of the heat-radiator and the circuit board to engage with an underside of the circuit board and an elastic member attached to the head for urging the heat-radiator towards the electronic device.

2. The fastener of claim **1**, wherein the elastic member is a cylindrical spring.

3. The fastener of claim **2**, wherein the head comprises an upper portion with a large diameter and a lower portion with a smaller diameter, and the spring is captured around said lower portion.

4. The fastener of claim **3**, wherein an annular groove is defined at a conjunction of the upper portion and the lower portion of the head to at least partially receive the spring therein.

5. The fastener of claim **1**, wherein the head has a straight hole defined longitudinally through a center of the head for the first end portion of the metallic wire traveling therethrough.

6. The fastener of claim **4**, wherein a slot is defined at a top and outside surface of the head and a distal portion of the first end portion of the metallic wire is received and fixed therein after traveling through the hole of the head.

7. The fastener of claim **1**, wherein the engaging portion of the metallic wire has an inverted taper profile and is formed by bending the second end portion of the metallic wire outwardly to form a first support and then bending it downwardly and inwardly to form a first leg, and then bending it to form a second leg and a second support which are symmetrical to the first leg and the first support, with a gap existed between the first and second supports.

8. A heat dissipating device for an electronic device on a circuit board, the circuit board having through holes defined thereon, the heat dissipating device comprising:

a heat-radiator located on the electronic device and defining through holes aligned with the holes of the circuit board; and

a fastener for attaching the heat-radiator to the electronic device, the fastener comprising:

a head extending through one of the through holes of the heat-radiator;

an elastic member attached to the head for exerting a spring force on the heat-radiator toward the electronic device; and

a metallic wire having a first end portion fixed on said head and a second end portion bent to form an engaging portion, the engaging portion compressively passing through corresponding through holes of the heat-radiator and the circuit board to engage with an underside of the circuit board whereby the electronic device is securely sandwiched between the heat-radiator and the circuit board.

9. The heat dissipating device of claim **8**, wherein the engaging portion of the metallic wire has an inverted taper profile and is formed by bending the second end portion of the metallic wire outwardly to form a first support, and then bending it downwardly and inwardly to form a first leg, and then bending it to form a second leg and a second support which are symmetrical to the first leg and the first support, with a gap existed between the first and second supports.

10. The heat dissipating device of claim **8**, wherein the head has a straight hole defined longitudinally through a center of the head for the first end portion of the metallic wire traveling therethrough.

11. The heat dissipating device of claim **10**, wherein a slot is defined at a top and outside surface of the head for receiving and fixing the first end portion of the metallic wire therein after traveling through the hole of the head.

12. The heat dissipating device of claim **8**, wherein the elastic member is a cylindrical spring.

13. The heat dissipating device of claim **12**, wherein the head comprises an upper portion with a large diameter and a lower portion with a smaller diameter, and the spring is captured around said lower portion and at least partially

received in an annular groove defined at a conjunction of the upper portion and the lower portion.

14. The heat dissipating device of claim **8**, wherein the second end portion of the metallic wire is located bellow the circuit board.

15. A heat dissipating device assembly comprising:

a printed circuit board defining at least a first through hole;

a heat generating device located upon the printed circuit board and beside said first through hole;

a heat dissipating device seated upon the heat generating device and comprising:

a heat-radiator located on the heat generating device and defining at least a second through hole aligned with the first through hole; and

a fastener for pressing the heat-radiator against the heat generating device, the fastener comprising:

a metal piece extending through both said first and second through holes with a hook upwardly abutting against a back face of the printed circuit board around said first through hole;

a head extending through the second through hole and defining a section retainably engaged with an upper section of the metal piece opposite to said hook; and

an elastic member defining an upper end urging the associated head and metal piece upwardly and a lower end urging the heat radiator downwardly.

* * * * *